

IN THE CLAIMS:

Kindly change claims 9, 10, 31 and 35, to read as follows.

- 1    1.    (previously presented) Apparatus for printing a  
2    desired image on a printing medium, based upon input  
3    image data, by construction from individual marks of at  
4    least one colorant, formed in a pixel grid; said apparatus comprising:  
5           for each colorant, at least one respective multielement  
6           printing array that is subject to colorant-deposition  
7           error;  
8           means for measuring such colorant-deposition error  
9           of the at least one array;  
10        means for modifying a multicolumn, multirow numerical  
11        tabulation that forms a mapping between such input  
12        image data and such marks, to compensate for the measured  
13        colorant-deposition error; and  
14        means for printing using the modified mapping.  
15
  
- 1    2.    (original) The apparatus of claim 1, wherein the  
2    mapping is selected from the group consisting of:  
3        an optical-density transformation of the image data  
4        to such construction from individual marks; and  
5        a spatial-resolution relationship between the image  
6        data and such pixel grid.

1 3. (original) The apparatus of claim 2, wherein:  
2 the optical-density transformation comprises a half-  
3 toning matrix; and  
4 the spatial-resolution relationship comprises a  
5 scaling of the image data to such pixel grid.

1 4. (previously presented) The apparatus of claim 1,  
2 wherein:  
3 said at least one multielement printing array com-  
4 prises a plurality of multielement printing arrays that  
5 print in a corresponding plurality of different colors or  
6 color dilutions, respectively, each multielement printing  
7 array being subject to a respective colorant-deposition  
8 error; and  
9 the measuring means and the mapping-modifying means  
10 each operate with respect to each one of the plurality of  
11 multielement printing arrays respectively.

1 5. (original) The apparatus of claim 4, wherein:  
2 for at least one of the plurality of multielement  
3 printing arrays, the colorant-deposition error comprises  
4 a respective pattern of printing-density defects; and  
5 wherein:  
6 the measuring means comprise means for measuring the  
7 pattern of printing-density defects for each multielement  
8 printing array respectively; and  
9 the modifying means comprising means for applying  
10 the respective pattern of defects, for at least one of  
11 the multielement printing arrays, to modify a respective  
12 said mapping.

1 6. (original) The apparatus of claim 4, wherein:  
2 for at least one of the plurality of multielement  
3 printing arrays, the colorant-deposition error comprises  
4 a swath-height error;  
5 the measuring means comprise means for measuring the  
6 swath-height error for each multielement printing array  
7 respectively; and  
8 the modifying means comprise means for applying the  
9 respective swath-height error, for at least one of the  
10 multielement printing arrays, to modify a respective said  
11 mapping.

1 7. (previously presented) The apparatus of claim 1,  
2 wherein:  
3 the colorant-deposition error comprises a pattern of  
4 printing-density defects;  
5 the measuring means comprise means for measuring the  
6 pattern of printing-density defects;  
7 the modifying means comprise:  
8  
9 means for deriving a correction pattern from  
10 the measured pattern of printing-density  
11 defects, and  
12  
13 means for applying the correction pattern to  
14 modify a halftone thresholding process;  
15 and  
16  
17 for each colorant, the printing means comprise means  
18 for printing such image incrementally, using the modified  
19 halftone thresholding process.

1 8. (previously presented) The apparatus of claim 1,  
2 wherein:  
3 the colorant-deposition error comprises a swath-  
4 height error or otherwise corresponds to an optimum dis-  
5 tance of printing-medium advance;  
6 the measuring means comprise means for measuring the  
7 swath-height error or determining the optimum distance;  
8 the modifying means comprise:  
9  
10 means for deriving a correction pattern from  
11 the measured swath-height error or deter-  
12 mined optimum distance, and  
13  
14 means for applying the correction pattern to  
15 modify a halftone thresholding process;  
16 and  
17  
18 for each colorant, the printing means comprise means  
19 for printing such image incrementally, using the modified  
20 halftone thresholding process.

1     9.     (currently amended) A method of printing a desired  
2     image, by construction from individual marks of at least  
3     one colorant, formed in a pixel grid by at least one mul-  
4     tielement printing array that is subject to a pattern of  
5     printing-density defects; said method comprising the  
6     steps of:  
7         measuring such pattern of printing-density defects;  
8         deriving a correction pattern from the measured pat-  
9     tern of printing-density defects;  
10        applying the correction pattern to modify a halftone  
11     thresholding process that uses a halftoning matrix which  
12     is a predefined numerical array;  
13        wherein the applying step comprises preparing a  
14     modified form of the predefined numerical array, and then  
15     using that modified form of the array; and  
16        for each said colorant, printing such image by said  
17     at least one multielement array respectively, using the  
18     modified halftone thresholding process.

1 10. (currently amended) The method of claim 9, for use  
2 with a printmask in plural-pass printing, said printmask  
3 being a defined system of numerical values, distinct from  
4 the measured pattern of defects and distinct from the de-  
5 derived correction pattern, that establishes the printing  
6 pass in which each ink mark is to be made; and further  
7 comprising the steps of, before or as a part of the ap-  
8 plying step:

9 using such printmask to determine a relationship be-  
10 tween the halftone matrix and the multielement array; and  
11 employing the relationship in the applying step to  
12 control application of the correction pattern to the  
13 halftone matrix.

1 11. (original) The method of claim 9, wherein:  
2 the printing step comprises single-pass printing.

1 12. (original) The method of claim 9, for use with said  
2 at least one multielement incremental-printing array that  
3 comprises a plurality of scanning multielement printing  
4 arrays that print in a corresponding plurality of differ-  
5 ent colors or color dilutions, each multielement printing  
6 array being subject to a respective swath-height error;  
7 and wherein:

8 the measuring, deriving, applying and printing steps  
9 are employed to modify swath height of at least one of  
10 the scanning multielement printing arrays, for accommo-  
11 dating any swath-height error present in each multiele-  
12 ment printing array respectively.

1 13. (original) The method of claim 9, for use with said  
2 at least one multielement incremental-printing array that  
3 comprises a plurality of multielement printing arrays  
4 that print in a corresponding plurality of different  
5 colors or color dilutions, each multielement printing ar-  
6 ray being subject to a respective pattern of printing-  
7 density defects; and wherein:

8 the measuring, deriving, applying and printing steps  
9 are each performed with respect to each multielement  
10 printing array respectively.



1 14. (original) The method of claim 13, for use with  
2 such plurality of multielement incremental-printing ar-  
3 rays that are also each subject to a respective swath-  
4 height error; and wherein:  
5 the measuring, deriving, applying and printing steps  
6 are also employed to modify swath height of at least one  
7 of the multielement printing arrays, for accommodating  
8 any swath-height error present in each multielement  
9 printing array respectively.

1 15. (original) The method of claim 9, wherein:  
2 the halftone thresholding process comprises defini-  
3 tion of a halftone matrix.

1 16. (original) The method of claim 9, wherein:  
2 the halftone thresholding process comprises an  
3 error-diffusion protocol.

1 17. (original) The method of claim 16, wherein the  
2 error-diffusion protocol comprises at least one of:  
3 a progressive error-distribution allocation protocol  
4 of such error-diffusion halftoning; and  
5 a decisional protocol for determining whether to  
6 mark a particular pixel.

- 1 18. (original) The method of claim 9, wherein:  
2 the applying step comprises replacing values above  
3 or below a threshold value.
- 1 19. (original) The method of claim 9, wherein:  
2 the applying step comprises multiplying values by a  
3 linear factor.
- 1 20. (original) The method of claim 9, wherein:  
2 the applying step comprises applying a gamma correc-  
3 tion function to values.
- 1 21. (original) The method of claim 9, wherein the  
2 modifying step comprises a combination of at least two  
3 of:  
4 replacing values above or below a threshold value;  
5 multiplying each values by a linear factor; and  
6 applying a gamma correction function to values.
- 1 22. (original) The method of claim 9, wherein:  
2 for each of the plurality of multielement arrays,  
3 the measuring, deriving and applying steps are each per-  
4 formed at most only one time for a full image.

1 23. (original) The method of claim 9, wherein:  
2 the applying step comprises modifying the darkness  
3 of substantially each mark printed by an individual  
4 printing element whose density is defective.

1 24. (original) The method of claim 9, wherein:  
2 the applying step comprises modifying the average  
3 number of dots printed by an individual printing element  
4 whose density is defective.

1 25. (previously presented) A method of printing a  
2 desired image, based on input image data, by construction  
3 from individual marks of at least one colorant, formed in  
4 a pixel grid by at least one scanning multielement print-  
5 ing array; said printing being subject to print-quality  
6 defects due to departure of printing-medium advance from  
7 an optimum value; said method comprising the steps of:  
8 measuring a parameter related to such print-quality  
9 defects;  
10 based on the measured parameter, scaling such input  
11 image data to compensate for said departure; and  
12 for each said colorant, printing such marks with  
13 said at least one scanning multielement array using the  
14 scaled input image data.

1 26. (original) The method of claim 25, wherein:  
2 the parameter comprises such print-quality defects;  
3 and  
4 the measuring step comprises measuring such print-  
5 quality defects.

1 27. (original) The method of claim 26, wherein:  
2 the defects comprise swath-height error; and  
3 the measuring step comprises measuring swath-height  
4 error.

1 28. (original) The method of claim 26, wherein:  
2 the defects comprise area-fill nonuniformity; and  
3 the measuring step comprises:  
4  
5 using a sensing system to measure area-fill  
6 nonuniformity for plural printing-medium  
7 advance values, and  
8  
9 selecting a printing-medium advance value that  
10 corresponds to minimum area-fill non-  
11 uniformity.

1 29. (original) The method of claim 25, wherein:  
2 the parameter comprises such optimum value; and  
3 the measuring step comprises determining such opti-  
4 mum value.

1 30. (original) The method of claim 25, for use with  
2 said at least one scanning multielement printing array  
3 that comprises a plurality of multielement printing ar-  
4 rays that print in a corresponding plurality of different  
5 colors or color dilutions, each multielement printing ar-  
6 ray being subject to a respective swath-height error;  
7 wherein:  
8 the measuring, scaling and printing steps are each  
9 performed with respect to each multielement printing  
10 array respectively.

1 31. (currently amended) The method of claim 30, where-  
2 in:  
3 at least some of the different printing arrays have  
4 optimum advance values or swath-height values that are,  
5 respectively, different from one another; and  
6 the printing step comprises:  
7  
8 comparing optimum advance values or swath-  
9 height values measured for the plurality  
10 of multielement printing arrays respec-  
11 tively, to find the smallest of said  
12 values;  
13  
14 selecting a particular multielement printing  
15 array whose said value is substantially  
16 the smallest;  
17  
18 using, in common for the plurality of printing  
19 arrays, substantially said selected small-  
20 est value; and  
21  
22 for substantially each array other than the  
23 particular array, operating with a respec-  
24 tive reduced number of printing elements  
25 and with rescaled data, to match an actual  
26 effective swath height of the particular  
27 array.

1 32. (original) The method of claim 31, wherein:  
2 said smallest of said values is determined taking  
3 into account the maximum available number of printing  
4 elements in the corresponding array.

1 33. (original) The method of claim 25, further compris-  
2 ing the step of:  
3 after the scaling step, iterating the measuring and  
4 scaling steps to allow for nonlinearity in such print-  
5 quality defects.

1 34. (previously presented) Apparatus for printing a  
2 desired image on a printing medium, based upon input  
3 image data, by construction from individual marks formed  
4 in a pixel grid; said apparatus comprising:  
5 at least one multielement incremental-printing array  
6 that is subject to colorant-deposition error;  
7 means for measuring such colorant-deposition error  
8 of the at least one array;  
9 means for modifying a multicolumn, multirow numeri-  
10 cal tabulation that forms a mapping between such input  
11 image data and such marks, to compensate for the measured  
12 colorant-deposition error; and  
13 means for printing using the modified mapping;  
14 wherein the multielement printing array is an inkjet  
15 printhead.

1 35. (currently amended) A method of printing a desired  
2 image, by construction from individual marks formed in a  
3 pixel grid by at least one multielement printing array  
4 that is subject to a pattern of printing-density defects;  
5 said method comprising the steps of:  
6       measuring such pattern of printing-density defects;  
7       deriving a correction pattern from the measured pat-  
8 tern of printing-density defects;  
9       applying the correction pattern to modify a halftone  
10 thresholding process that uses a halftoning matrix which  
11 is a predefined numerical array;  
12       wherein the applying step comprises preparing a  
13 modified form of the predefined numerical array, and then  
14 using that modified form of the array; and  
15       printing such image using the modified halftone  
16 thresholding process;  
17       wherein the multielement printing array is an inkjet  
18 printhead.



1 36. (previously presented) A method of printing a  
2 desired image, based on input image data, by construction  
3 from individual marks formed in a pixel grid by at least  
4 one scanning multielement printing array; said printing  
5 being subject to print-quality defects due to departure  
6 of printing-medium advance from an optimum value; said  
7 method comprising the steps of:  
8       measuring a parameter related to such print-quality  
9 defects;  
10       based on the measured parameter, scaling such input  
11 image data to compensate for said departure; and  
12       printing such image using the scaled input image  
13 data;  
14       wherein the multielement printing array is an inkjet  
15 printhead.

1 37. (previously presented) Apparatus for printing a  
2 desired image on a printing medium, based upon input  
3 image data, by construction from individual marks of at  
4 least one colorant, formed in a pixel grid; said appa-  
5 ratus comprising:  
6       for each colorant, respective means for printing  
7 incrementally in that colorant;  
8       each said printing means, for a particular one col-  
9 orant, comprising at least one respective incremental-  
10 printing array that is subject to colorant-deposition  
11 error;  
12       means for measuring such colorant-deposition error  
13 of the at least one array;  
14       means for modifying a multicolumn, multirow numeri-  
15 cal tabulation that forms a mapping between such input  
16 image data and such marks, to compensate for the measured  
17 colorant-deposition error; and  
18       means for printing using the modified mapping.

1 38. (previously presented) Apparatus for printing a  
2 desired image on a printing medium, based upon input  
3 image data, by construction from individual marks formed  
4 in a pixel grid; said apparatus comprising:  
5 at least one multihundred-element printing array  
6 that is subject to colorant-deposition error;  
7 means for measuring such colorant-deposition error  
8 of the at least one array;  
9 means for modifying a multicolumn, multirow numeri-  
10 cal tabulation that forms a mapping between such input  
11 image data and such marks, to compensate for the measured  
12 colorant-deposition error; and  
13 means for printing using the modified mapping.

1 39. (previously presented) The apparatus of claim 38,  
2 wherein:  
3 the multihundred-element array has at least three  
4 hundred printing elements.

1 40. (previously presented) Apparatus for printing a  
2 desired image on a printing medium, based upon input  
3 image data, by construction from individual marks formed  
4 in a pixel grid; said apparatus comprising:  
5 at least one multielement incremental printing  
6 array, having at least thirty printing elements, that is  
7 subject to colorant-deposition error;  
8 means for measuring such colorant-deposition error  
9 of the at least one array;  
10 means for modifying a multicolumn, multirow numeri-  
11 cal tabulation that forms a mapping between such input  
12 image data and such marks, to compensate for the measured  
13 colorant-deposition error; and  
14 means for printing using the modified mapping.

1 41. (previously presented) The apparatus of claim 40,  
2 wherein:  
3 the at least one multielement incremental printing  
4 array comprises a scanning printhead or a full-page-width  
5 printhead.

1 42. (previously presented) The apparatus of claim 40,  
2 wherein:  
3 the printing means comprise at least one micropro-  
4 cessor controlling all of the at least thirty elements  
5 simultaneously during printing to select, and selectively  
6 actuate, particular elements for printing of particular  
7 pixels respectively.